

SECTION 08 44 00.01 00

CURTAIN WALL AND GLAZED ASSEMBLIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

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| AA ADM | (2015) Aluminum Design Manual |
| AA ASD1 | (2013) Aluminum Standards and Data |
| AA DAF45 | (2003; Reaffirmed 2009) Designation System
for Aluminum Finishes |

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

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| AAMA 1503 | (2009) Voluntary Test Method for Thermal
Transmittance and Condensation Resistance
of Windows, Doors and Glazed Wall Sections |
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AM#9...

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| AAMA 501.2 | (2009) Quality Assurance and Diagnostic
Water Leakage Field Check of Installed
Storefronts, Curtain Walls and Sloped
Glazing Systems...AM#9 |
| AAMA 501.4 & 501.6 | (2009) Recommended Static Test Method for
Evaluating Curtain Wall and Storefront
Systems Subjected to Seismic and Wind
Induced Interstory Drifts & Recommended
Dynamic Test Method for Determining the
Seismic Drift Causing Glass Fallout from a
Wall System |
| AAMA 609 & 610 | (2009) Cleaning and Maintenance Guide for
Architecturally Finished Aluminum |
| AAMA 611 | (1998; R 2004) Voluntary Specification for
Anodized Architectural Aluminum |
| AAMA 800 | (2010) Voluntary Specifications and Test
Methods for Sealants |
| AAMA CW-10 | (2004) Care and Handling of Architectural
Aluminum from Shop to Site |
| AAMA MCWM-1 | (1989) Metal Curtain Wall Manual |
| AAMA/WDMA/CSA 101/I.S.2/A440 | (2011) Standard/Specification for Windows, |

Doors, and Skylights

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A27/A27M	(2013) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A47/A47M	(1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings
ASTM B136	(1984; R 2013) Standard Method for Measurement of Stain Resistance of Anodic Coatings on Aluminum
ASTM B137	(1995; R 2014) Standard Test Method for Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B211	(2012) Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire
ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2013) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B244	(2009; R 2014) Standard Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
ASTM B316/B316M	(2010) Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods
ASTM C920	(2014a) Standard Specification for Elastomeric Joint Sealants
ASTM D1781	(1976) Climbing Drum Peel Test for Adhesives, D3363-74: Method for Film Hardness by Pencil Test.
ASTM D2794	(1993; R 2010) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

ASTM D3359	(2009; E 2010; R 2010) Measuring Adhesion by Tape Test
ASTM E1300	(2012a; E 2012) Determining Load Resistance of Glass in Buildings
ASTM E283	(2004; R 2012) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330/E330M	(2014) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E331	(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E34	(2011) Chemical Analysis of Aluminum and Aluminum-Base Alloys
ASTM E546	(2014) Frost Point of Sealed Insulating Glass Units
ASTM E576	(2014) Frost Point of Sealed Insulating Glass Units in the Vertical Position
ASTM F1642	(2012) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F2248	(2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500	(2006) Metal Finishes Manual
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1.2 RELATED REQUIREMENTS

Refer to Section 01 91 00.01 15 TOTAL BUILDING COMMISSIONING and 01 91 19.01 00 EXTERIOR ENCLOSURE COMMISSIONING for general Cx process requirements, definition of Cx team members, and delineation of responsibilities.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submittals with an "S" designation following the "G" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29.01 00 SUSTAINABILITY REPORTING. Other designations following the "G" designation identify the office that will review the submittal for the

Government. Submit the following in accordance with Section 01 33 00.01 00
SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Glazed Curtain Wall System; G JC

Submit for curtain wall system, accessories, and mock-up. Drawings must indicate in detail all system parts including elevations, full-size sections, framing, jointing, panels, types and thickness of metal, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, firestopping insulation materials, and erection details.

SD-03 Product Data

Glazed Curtain Wall System; G JC

Include descriptive literature, detailed specifications, and available performance test data.

Curtain Wall Doors; G JC

Preventive Maintenance and Inspection; G JC

Metals For Curtain Wall Fabrication; G JC

Nonskinning Sealing Compound; G JC

Metal Accessories; G JC

Curtain-Wall Framing Members

Sealants and Caulkings; G JCS

Insulated Metal Panel Transom; G JC

Recycled Content; G JS

Local/Regional Materials; G JS

Low Emitting Materials; G JS

Sample Warranties; G JC

SD-05 Design Data

Calculations; G J

Finish; G J

Seismic Calculations; G J

SD-08 Manufacturer's Instructions

Glazed Curtain Wall System; G J

Curtain Wall Doors; G J

SD-11 Closeout Submittals

Warranty; G J

1.4 REQUIREMENT FOR DESIGN DATA

Submit structural and thermal calculations for complete wall assembly.

1.5 QUALITY ASSURANCE

1.5.1 Testing Requirements

The components listed below must be tested in accordance with the requirements below, and meet performance requirements specified.

- a. Joint and Glazing Sealants: Perform tests as required by applicable publications referenced.
- b. Anodized Finishes: Stain resistance, coating weight, and coating thickness tests, ASTM B136, ASTM B137, and ASTM B244, respectively.
- c. Insulating Glass: ASTM E546 or ASTM E576 at minus 20 degrees F, no frost or dew point.

1.5.2 Factory Tests

1.5.2.1 Deflection and Structural Tests

Curtain wall framing members shall be designed to resist deflection, in a direction normal to the plane of the wall, to no more than 1/175 of its clear span or 3/4 inch, whichever is less, when tested in accordance with ASTM E330/E330M. No framing member shall have a permanent deformation in excess of 0.2 percent of its clear span when tested in accordance with ASTM E330/E330M for a minimum test period of 10 seconds at 1.5 times the design wind pressures specified.

Curtain wall doors, frames and hardware shall be designed to resist equivalent static design loads in accordance with ASTM F1642. Frame deflections shall not exceed L/160 of the unsupported member lengths. Equivalent static design loads for connections of window or door frame to the surrounding walls or hardware and associated connections, and glazing stop connections shall be in accordance with ASTM F2248 and ASTM E1300. Design supporting elements and their connections based on their ultimate capacities. Provide calculations of a Professional Engineer that substantiates compliance with these requirements. Frames shall provide an equivalent level of performance. Shapes and thicknesses of framing members shall be sufficient to withstand a design wind load of not less than the design wind load indicated with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65. Provide glazing beads, moldings, and trim of not less than 1.25 mm 0.050 inch nominal thickness.

1.5.2.2 Water Penetration Test

No water penetration shall occur when the wall is tested in accordance with ASTM E331 at a differential static test pressure of 20 percent of the inward acting design wind pressure as specified, but not less than 15 psf.

Make provision in the wall construction for adequate drainage to the outside of water leakage or condensation that occurs within the outer face of the wall. Leave drainage and weep openings in members and wall open during test.

Curtain wall doors, tested in accordance with ASTM E331, must not permit water penetration at a pressure of 8 pounds per square foot of fixed area.

1.5.2.3 Air Infiltration Test

Curtain wall air infiltration, when tested in accordance with ASTM E283 at a test pressure of 6.24 pounds per square foot (50 mile per hour wind), must not exceed 0.06 cfm per square foot of fixed wall area.

Curtain wall doors air infiltration must not exceed 0.06 cubic feet per minute per square foot of fixed area at a test pressure of 6.24 pounds per square foot (50 mile per hour wind) when tested in accordance with ASTM E283.

1.5.2.4 Thermal Conductance Tests

The thermal transmittance of opaque panels must not exceed specified U-value, when tested in accordance with AAMA 1503. The average calculated thermal transmittance of the complete wall assembly including panels, windows, and all other components must not exceed a U-value of 0.24.

1.6 GLAZED CURTAIN WALL SYSTEM REQUIREMENTS

Provide system complete with framing, mullions, trim, doors, windows, glass, glazing, sealants, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing the wall to the structure as specified or indicated.

1.6.1 Source

Furnish curtain wall system components by one manufacturer or fabricator; however, all components need not be products of the same manufacturer.

1.6.2 Design

Stick built captured edge system with mullions, and horizontal rails. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and insure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified.

1.6.3 Thermal Movement

Fabricate, assemble, and erect system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects. For design purposes, base provisions for thermal movement on assumed ambient temperature range of from -50 degrees F to 120 degrees F.

1.6.4 Tolerances

Design and erect wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified. Provide with the following tolerances:

- a. Maximum variation from plane or location shown on approved shop drawings: 1/8 inch per 12 feet of length up to not more than 1/2 inch in any total length.
- b. Maximum offset from true alignment between two identical members abutting end to end in line: 1/16 inch.

1.6.5 Structural Requirements

Members may not deflect in a direction parallel to the plane of the wall, when carrying its full design load, more than an amount which will reduce the edge cover or glass bite below 75 percent of the design dimension. After deflection under full design load, members may not have a clearance between itself and the top of the panel, glass, sash, or other part immediately below it less than 1/8 inch. The clearance between the member and an operable door must be minimum 1/16 inch. Design entire system to withstand the indicated wind and concentrated loads. Refer to structural drawings including wind pressure maps for Risk Category and at each building level and corner areas for outward-inward acting design pressures.

1.6.6 Seismic Calculations

When tested to AAMA 501.4 & 501.6, system must meet design displacement of 0.010 times the story height and ultimate displacement of 1.5 times the design displacement. Provide with the following tolerances:

- a. Phase I: 3 stroke cycles using .005 times the story height - no damage or failure.
- b. Phase II: 3 stroke cycles using .010 times the story height - no damage or failure.

1.7 DELIVERY AND STORAGE

Inspect materials delivered to the site for damage; unload and store with a minimum of handling in accordance with recommendations contained in AAMA CW-10. Storage spaces must be dry locations with adequate ventilation, free from heavy dust, not subject to combustion products or sources of water, and must allow for easy access for inspection and handling. Deliver caulking and sealing compounds to the job site in sealed containers labeled to show the designated name, formula or specifications number; lot number; color; date of manufacturer; shelf life; and curing time when applicable.

1.7.1 Protective Covering

Prior to shipment from the factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of aluminum with protective covering of adhesive paper, waterproof tape, or strippable plastic. Covering must not chip, peel, or flake due to temperature or weather, must protect against discoloration and surface damage from transportation, and storage, and must be resistant to alkaline mortar and plaster. Do not cover aluminum surfaces that will be in contact with sealants after installation.

1.7.2 Identification

Prior to delivery, mark wall components to correspond with shop and

erection drawings placement location and erection.

1.8 WARRANTY

Guarantee insulating glass units not to develop material obstruction of vision as a result of dust or film formation on the inner glass surface caused by failure of the seal, other than through glass breakage, within a period of 5 years from date of acceptance of work by the Government. Replace units failing to comply with the terms of this guarantee with new units without additional cost to the Government. The Contractor must require the manufacturer to execute their warranties in writing directly to the Government.

1.8.1 Sample Warranties

Provide curtain wall and glazing assembly material and workmanship warranties meeting specified requirements. Provide revision or amendment to standard membrane manufacturer warranty to comply with the specified requirements.

- a. Project Warranty: Refer to Section 01 11 00.01 00 SUMMARY OF WORK and Section 01 33 00.01 00 SUBMITTAL PROCEDURES for project warranty provisions.
- b. Manufacturer's Warranty: Submit, for Owner's acceptance, Manufacturer's standard warranty document executed by authorized company official manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.
- c. Beneficiary: Issue warranty in the legal name of the project Owner.
- d. Warranty Period: Two years commencing on Date of Substantial Completion, covering complete curtain wall system for failure to meet specified requirements.
- e. Warranty Acceptance: Owner is sole authority who will determine acceptability of manufacturer's warranty documents.

1.9 QUALIFICATIONS FOR THE CURTAIN-WALL INSTALLER

Submit a written description of the proposed curtain-wall system installer giving the name of the curtain-wall manufacturer, qualifications of personnel, years of concurrent contracting experience, lists of projects similar in scope to the specified work, and other information as may be required by the Contracting Officer.

1.10 PERFORMANCE REQUIREMENTS

1.10.1 Allowable Design Stresses

Aluminum-alloy framing member allowable design stresses must be in accordance with the requirements of AA ADM pertaining to building type structures made of the specified aluminum alloy.

1.10.2 Structural Capacity

Design curtain-wall system, including framing members, windows, door frames, metal accessories, panels, and glazing to withstand the specified design windload acting normal to the plane of the curtain wall and acting

either inward or outward.

Deflection of any metal framing member in a direction normal to the plane of the curtain wall, when subjected to the test of structural performance, using the specified windload in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, must not exceed 1/175 of the clear span of the member or 3/4 inch, whichever value is less.

Deflection of any metal member in a direction parallel to the plane of the curtain wall, when the metal member is carrying its full design load, must not exceed 75 percent of the design clearance dimension between that member and the glass, sash, panels, or other part immediately below it.

1.10.3 Provisions for Thermal Movement

Design curtain-wall systems, including framing members, windows, doors, metal accessories, and other components incorporated into the curtain wall, to allow for expansion and contraction of the component parts at an ambient temperature of 75 degrees F without causing buckling, opening of joints, overstressing of fasteners, or other harmful effects.

1.11 SHOP DRAWINGS

Curtain-wall shop drawings shall indicate locations in building, layout and elevations, dimensions, shapes and sizes of members, thickness of metals, types and locations of shop and field connections, details of anchorage to building construction, glazing provisions, and other pertinent construction and erection details.

Panel dimensions, thicknesses and kinds of materials, edge details, details of installation in curtain-wall framing, and other pertinent construction and erection details.

Curtain wall door shop drawings shall indicate elevations of doors, windows and frames, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, method and materials for weatherstripping, material and method of attaching subframes, trim, installation details, and other related items.

1.12 MANUFACTURER'S INFORMATION

Preventive Maintenance and Inspection must consist of the aluminum manufacturer's recommended cleaning materials and application methods, including detrimental effects to the aluminum finish when improperly applied.

1.13 SUSTAINABLE DESIGN REQUIREMENTS

1.13.1 Recycled Content

Use materials or products where recycled content is clearly identifiable by the manufacturer, indicating the total sum of post-consumer recycled content, plus one-half of the pre-consumer content. See Section 01 33 29.01 00 SUSTAINABILITY REPORTING for cumulative total recycled content requirements.

1.13.2 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources. See Section 01 33 29.01 00 SUSTAINABILITY REPORTING for cumulative total local material requirements.

1.13.3 Low Emitting Materials

Use low emitting materials for all interior adhesives, sealants, paints, and coatings systems, in accordance with the following requirements:
All interior adhesives and sealants shall meet low-VOC requirements in accordance with SCAQMD Rule 1168, dated July 1, 2005.

All interior paints, coatings and sealers shall meet low-VOC requirements as follows: All architectural paints, coating and primers applied to interior walls and ceiling shall meet low-VOC requirements in accordance with the GS-11, dated May 20, 1998.

All anti-corrosive and anti-rust paints applied to ferrous metal substrates shall meet low-VOC requirements in accordance with the GS-03, dated January 7, 1997.

All composite wood, agrifiber products, and laminating adhesives used for assemblies shall contain no added urea-formaldehyde.

All material installed in the building interior must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda. Products with GREENGUARD Gold Certification or that meet California's Section 01350 criteria also meet the requirements for LEED credit.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum

Must be free from defects impairing strength or durability of surface finish. Provide standard alloys conforming to standards and designations of AA ASD1. Special alloys, not covered by the following ASTM specifications, must conform to standards and designations recommended by the manufacturer for the purpose intended.

Provide Aluminum Frames and Curtain-wall Framing Members with a minimum recycled content of 20 percent.

2.1.1.1 Wrought Aluminum Alloys

Must be those which include aluminum alloying elements not exceeding the following maximum limits when tested and additional in accordance with ASTM E34. These limits apply to both bare products and the core of clad products. The cladding of clad products must be within the same limits except that the maximum zinc limit may be 2.5 percent in order to assure that the cladding is anodic to the core. Special wrought alloys with a silicon content not more than 7.0 percent will be acceptable for limited structural uses where special appearance is required:

Within the chemical composition limits set forth above, wrought aluminum alloys must conform to the following:

- a. Extruded bars, rods, shapes and tubes: ASTM B221.

2.1.1.2 Finish

Anodized finish on aluminum surfaces must match in appearance or fall within the two extremes of color range of the approved samples. The following designation of finishes refer to standard finishes as defined in the NAAMM AMP 500. Aluminum used for framing must have a clear anodized finish designation AA-M10-C21-A41/AA-M45-C22-A41 and AAMA611, meeting the requirements of AAMA 611.

2.1.1.3 Strength

Aluminum extrusions for framing members used in curtain walls and main frame and sash or ventilator members in windows must have a minimum ultimate tensile strength of 22,000 psi and a minimum yield strength of 16,000 psi.

2.1.2 Metal Fasteners

Provide fasteners as specified in paragraph entitled "Fastener Metals for Joining Various Metal Combinations" in "Part 2 - Products" of the AAMA MCWM-1. Metals for fasteners must be chemically and galvanically compatible with contiguous materials.

2.1.3 Joint Sealants and Accessories

Provide manufacturer's standard colors to closely match adjacent surfaces. For interior application of joint sealants comply with applicable regulations regarding reduced VOC's as specified in Section 07 92 00.01 00 JOINT SEALANTS.

2.1.3.1 Elastomeric, Single or Multiple Component

ASTM C920, Type S, single component. Use Grade NS, nonsag type in joints on vertical surfaces and use Grade P, self-leveling or flow type, in joints on horizontal surfaces.

2.1.3.2 Single Component Silicone Rubber Base

ASTM C920, Type S, Grade NS (Silicone).

2.1.3.3 Solvents and Primers

Provide material which is quick drying, colorless, nonstaining, compatible with compound used, as recommended by sealant manufacturer. Where primer is specified or recommended by sealant manufacturer, tests related to that material must include primer.

2.1.3.4 Backing Material

Provide material which is nonstaining, nonabsorbent, and compatible with sealing compound. Closed cell resilient urethane, polyvinylchloride or polyethylene foam; closed-cell sponge of vinyl or rubber; closed cell neoprene or butyl rod; or polychloroprene tubes or beads.

2.1.3.5 Bond Preventive Materials

Provide polyethylene tape with pressure-sensitive adhesive; aluminum foil or waxed paper.

2.1.4 Glass and Glazing

Materials are specified under Section 08 81 00.01 00 GLAZING.

2.1.4.1 Glass Setting Materials

- a. Sealants and preformed sealing compounds: Must be as specified under paragraph entitled "Joint Sealant and Accessories."
- b. Setting blocks, edge blocks, and spacer shims: Fabricate from neoprene or other materials recommended by glass manufacturer compatible with compounds, sealants, or gaskets used. Unless otherwise recommended by the glass manufacturer, shore "A" Durometer hardness for setting and edge blocks must be 90 plus or minus 5; for spacer shims, 50 plus or minus 5.

2.1.5 Metal Accessories

Metal sills and door frames. Fabricate accessories of sizes and shapes indicated from similar materials and finish as specified for wall system.

2.2 SILLS

Sills must be the shapes and dimensions indicated and fabricated of aluminum-alloy extrusions having a wall thickness not less than 0.125 inch.

Sills must run continuously under the curtain wall and permit the lower curtain wall frame member to interlock without fastenings.

2.3 NONSKINNING SEALING COMPOUND

Sealing compound must be nonskinning, gun-grade type conforming to AAMA 800.

2.4 SEALANTS AND CAULKINGS

Sealants and caulking are specified in Section 07 92 00.01 00 JOINT SEALANTS.

2.5 METALS FOR CURTAIN WALL FABRICATION

2.5.1 Aluminum-Alloy Extrusions

Extrusions must conform to ASTM B221.

2.5.2 Aluminum-Alloy Sheets and Plates

Unless otherwise specified, sheets and plates must conform to ASTM B209, Alloy 3003-H16.

Sheets and plates to receive a clear anodic coating must conform to ASTM B209, Alloy 5005-H16.

2.5.3 Metals for Fasteners

Provide aluminum-alloy bolts and screws made from rod conforming to ASTM B211, Alloy 2024-T351.

Provide aluminum-alloy nuts made from rod conforming to ASTM B211, Alloy 6061-T6.

Provide aluminum-alloy washers made from sheet conforming to ASTM B209, Alloy 2024-T4.

Provide aluminum-alloy rivets made from rod or wire conforming to ASTM B316/B316M, Alloy 6053-T61.

Provide steel fasteners made from corrosion-resistant chromium-nickel Type 302, 303, 304, 305, or 316 with the form and condition best suited for the work.

2.6 CURTAIN WALL FABRICATION

2.6.1 Workmanship

Metal Accessories must be accurately formed; joints, except those designed to accommodate movement, accurately fitted and rigidly assembled.

2.6.2 Depth of Glazing Rabbets

Depth of glazing rabbets for openings to receive glass materials or panels must be 3/4-inch minimum.

2.6.3 Finish

Exposed-to-View Aluminum Finish of surfaces must be:

Frosted finish with Class I clear anodic coating: Medium-matte chemical etch and Architectural Class I (0.7-mil and greater thickness) anodic coating producing a natural aluminum color. Finish must be AA C22-A41 in accordance with AA DAF45.

Test the anodic coating on aluminum for thickness in accordance with ASTM B244.

Test anodically coated aluminum for the weight of the coating in accordance with ASTM B137.

Test the resistance of anodically coated aluminum to staining by dyes in accordance with ASTM B136.

2.7 CURTAIN-WALL INSTALLATION MATERIALS

2.7.1 Wedge Concrete Inserts

Galvanized, box-type, ferrous castings with an integral loop at the back of the box and designed for 3/4-inch diameter bolts with wedge-shaped heads must conform to ASTM A47/A47M, or ASTM A27/A27M, Grade U-60-30, and hot-dip galvanized in accordance with ASTM A153/A153M.

Carbon steel bolts with wedge-shaped heads, nuts, washers, and shims must be hot-dip galvanized in accordance with ASTM A153/A153M.

2.7.2 Steel Bolts, Nuts, and Washers

Bolts must be regular hexagon head, low-carbon steel.

Nuts must be hexagon, regular style, carbon steel.

Plain washers must be round, general-assembly purpose, carbon steel.

Lockwashers must be helical spring, carbon steel.

2.8 CURTAIN-WALL FRAMING MEMBERS

2.8.1 General

Curtain-wall framing must be the grid type with the vertical and horizontal mullions extending the indicated distance beyond the exterior face of the curtain wall.

2.8.2 Curtain Wall Construction

Framing members must be aluminum-alloy extrusions with a wall thickness not less than 0.125 inch. Glazing rabbet legs must be an integral part of the frame with the leg depth not less than the minimum depth specified for the thickness and size of the glass material or panel to be installed in the curtain-wall frame.

Prepare vertical mullions for anchorage to the building construction at the bottom, at each intermediate floor elevation, and at the top.

Corners of frames must be mortise-and-tenon construction. Corner joints must be accurately fitted and flush, with watertight hairline joints not exceeding 1/64 inch in width. Apply nonskinning sealing compound to the unexposed surfaces of all mortise-and-tenon joints.

2.9 CURTAIN WALL DOORS

Swing-type aluminum doors of size, design, and location indicated. Provide doors complete with framing members, and accessories.

2.10 MATERIALS

2.10.1 Anchors

Stainless steel or steel with hot-dipped galvanized finish.

2.10.2 Weatherstripping

Continuous wool pile, silicone treated, or type recommended by door manufacturer.

2.10.3 Aluminum Alloy for Doors

ASTM B221M ASTM B221, Alloy 6063-T5 for extrusions. ASTM B209M ASTM B209, alloy and temper best suited for aluminum sheets and strips.

2.10.4 Fasteners

Hard aluminum or stainless steel.

2.10.5 Structural Steel ASTM A36/A26M.

2.10.6 Aluminum Paint

Aluminum door manufacturer's standard aluminum paint.

2.10.7 Curtain Wall Door Fabrication

Of type, size, and design indicated and not less than 2 1/4 inch thick. Minimum wall thickness, 0.125 inch, except beads and trim, 0.050 inch. Door sizes shown are nominal and shall include standard clearances as follows: 0.093 inch at hinge and lock stiles, 0.125 inch between meeting stiles, 0.125 inch at top rails, 0.187 inch between bottom and threshold, and 0.687 inch between bottom and floor. Bevel single-acting doors 0.063 or 0.125 inch at lock, hinge, and meeting stile edges.

2.10.7.1 Full Glazed Stile and Rail Doors

Doors shall have medium stiles and rails as indicated. Fabricate from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Fasten top and bottom rail together by means of welding or by 3/8 or 1/2 inch diameter cadmium-plated tensioned steel tie rods. Provide an adjustable mechanism of jack screws or other methods in the top rail to allow for minor clearance adjustments after installation.

2.10.7.2 Welding and Fastening

Where possible, locate welds on unexposed surfaces. Dress welds on exposed surfaces smoothly. Select welding rods, filler wire, and flux to produce a uniform texture and color in finished work. Remove flux and spatter from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and shall have countersunk heads. Weld concealed reinforcements for hardware in place.

2.10.8 Insulated Metal Panel Transom

Provide Laminated metal faced panels with solid plastic substrates on interior and exterior, installed in the curtain wall system where indicated on drawings. Panels shall have custom color Kynar finish on interior and exterior face. Panel thickness to be 1-3/4 inches with isocyanate core to provide an R value of 11.88. Panels shall conform with ASTM E330/E330M, ASTM D1781, ASTM D2794, ASTM D3359.

2.10.9 Weatherstripping

Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping shall be replaceable without special tools, and adjustable at meeting rails of pairs of doors. Installation shall allow doors to swing freely and close positively. Air leakage of a single leaf weatherstripped door shall not exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

2.10.10 Anchors

On the backs of subframes, provide anchors of the sizes and shapes indicated for securing subframes to adjacent construction. Anchor transom

bars at ends and mullions at head and sill. Place anchors near top and bottom of each jamb and at intermediate points not more than 25 inch apart.

2.10.11 Provisions for Hardware

Coordinate with Section 08 71 00.01 00 DOOR HARDWARE. Cut, reinforce, drill, and tap doors at the factory to receive hardware. Provide doors to receive surface-applied hardware, except kick plates with reinforcing only; drill and tap in the field. Provide hardware reinforcements of stainless steel or steel with hot-dipped galvanized finish, and secure with stainless steel screws. Provide reinforcement in core of doors as required to receive locks, door closers, and other hardware.

2.10.12 Provisions for Glazing

Provide extruded aluminum snap-in glazing beads on interior side of doors. Provide extruded aluminum, theft-proof, snap-in glazing beads or fixed glazing beads on exterior or security side of doors. Glazing beads shall have vinyl insert glazing gaskets. Design glazing beads to receive glass of thickness indicated or specified.

2.10.13 Finishes

Exposed-to-View Aluminum Finish of surfaces must be:

Frosted finish with Class I clear anodic coating: Medium-matte chemical etch and Architectural Class I (0.7-mil and greater thickness) anodic coating producing a natural aluminum color. Finish must be AA C22-A41 in accordance with AA DAF45.

Test the anodic coating on aluminum for thickness in accordance with ASTM B244. Test anodically coated aluminum for the weight of the coating in accordance with ASTM B137. Test the resistance of anodically coated aluminum to staining by dyes in accordance with ASTM B136.

PART 3 EXECUTION

3.1 GENERAL

Install curtain walls, doors and accessories in accordance with the approved drawings and as specified.

3.2 CURTAIN WALL FABRICATION

Provide curtain wall components of the materials and thickness indicated or specified. The details indicated are representative of the required design and profiles. Acceptable designs may differ from that shown if the proposed system components conform to the limiting dimensions indicated and the requirements specified herein. Unless specifically indicated or specified otherwise, the methods of fabrication and assembly must be at the discretion of the curtain wall manufacturer. Perform fitting and assembling of components in the shop to the maximum extent practicable. Provide anchorage devices with adjustment capability in three directions. Exposed fastenings used on finished surfaces must be truss head, flat head, or oval head screws or bolts.

3.2.1 Joints

Provide welded or mechanical fasteners as indicated or specified. Match

joints in exposed work to produce continuity of line and design. Bed-joints or rabbets receiving caulking or sealing material must be minimum 3/4 inch deep and 3/8 inch wide at mid ambient temperature range.

3.2.2 Ventilation and Drainage

Provide internal ventilation drainage system of weeps or based on principles of pressure equalization to ventilate the wall internally and to discharge condensation and water leakage to exterior as inconspicuously as possible. Flashings and other materials used internally must be nonstaining, noncorrosive, and nonbleeding.

3.2.3 Protection and Treatment of Metals

3.2.3.1 General

Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving the shop.

3.2.3.2 Galvanic Action

Provide protection against galvanic action wherever dissimilar metals are in contact, except in the case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint or apply appropriate caulking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

3.2.3.3 Protection for Aluminum

Protect aluminum which is placed in contact with, built into, or which will receive drainage from masonry, lime mortar, concrete, or plaster with one coat of alkali-resistant bituminous paint. Where aluminum is contacted by absorptive materials subject to repeated wetting or treated with preservative noncompatible with aluminum, apply two coats of aluminum paint, to such materials and seal joints with approved caulking compound.

3.3 CURTAIN WALL INSTALLATION

Installation and erection of glazed wall system and all components must be performed under direct supervision of and in accordance with approved recommendations and instructions of wall system manufacturer or fabricator.

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

3.3.1 Verifying Conditions and Adjacent Surfaces

After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in the building frame.

3.3.2 Windows

3.3.2.1 Sealing

Seal exterior metal to metal joints between members of windows, frames,

mullions, and mullion covers. Remove excess sealant.

3.3.3 Joint Sealants

3.3.3.1 Surface Preparation

Surfaces to be primed and sealed must be clean, dry to the touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions must conform to approved detail drawings with a tolerance of plus 1/8 inch. Do not apply compound unless ambient temperature is between 40 and 90 degrees F. Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings must be of type that leave no residue on metals.

3.3.3.2 Applications

Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound must be uniformly smooth and free of wrinkles and, unless indicated otherwise, tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four hours, not to exceed 5 gallons at any given time.

3.3.3.3 Primer

Apply to masonry, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after caulking is completed.

3.3.3.4 Backing

Tightly pack in bottom of joints which are over 1/2 inch in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.

3.3.3.5 Bond Prevention

Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.

3.3.3.6 Protection and Cleaning

Remove compound smears from surfaces of materials adjacent to sealed joints as the work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of caulking and sealing, remove remaining smears, stains, and other soiling, and leave the work in clean neat condition.

3.3.4 Glass

Install in accordance with manufacturer's recommendations as modified herein.

3.3.4.1 Inspection of Sash and Frames

Before installing glass, inspect opening to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.

3.3.4.2 Preparation of Glass and Rabbets

Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer.

3.3.4.3 Positioning Glass

Maintain specified edge clearances and glass bite at perimeter. Maintain position of glass in rabbet and provide required sealant thickness on both sides of glass. For glass dimensions larger than 50 united inches, provide setting blocks at sill and spacer shims on all four sides; locate setting blocks one quarter way in from each jamb edge of glass. Where setting blocks and spacer shims are set into glazing compound or sealant, butter with compound or sealant, place in position, and allow to firmly set prior to installation of glass.

3.3.4.4 Setting Methods

Apply glazing compound, glazing sealant, glazing tape, and gaskets uniformly with accurately formed corners and bevels. Remove excess compound from glass and sash. Use only recommended thinners, cleaners, and solvents. Strip surplus compound from both sides of glass and tool at slight angle to shed water and provide clean sight lines. Secure stop beads in place with suitable fastenings. Do not apply compound or sealant at temperatures lower than 40 degrees F, or on damp, dirty, or dusty surfaces. After glazing, fix ventilators in sash so they cannot be operated until compound or sealant has set.

- a. Use compression gasket glazing, with compression gaskets both sides of glass and adjustable or snap-on interior stops.

3.3.4.5 Void Space

Provide void space at head and jamb to allow glass to expand or move without exuding the sealant.

3.3.4.6 Insulating Glass

Provide adequate means to weep incidental water and condensation away from the sealed edges of insulated glass units and out of the wall system.

3.4 FIELD TESTS

Conduct field check test for water leakage on designated wall areas after erection. Conduct test on **AM#9...minimum of 50 square feet of wall area....AM#9** Conduct test and take necessary remedial action as described in **AM#9...AAMA 501.2....AM#9**

3.5 CURTAIN WALL DOOR INSTALLATION

Plumb, square, level, and align framing members to receive doors.

Hang doors to produce clearances specified in this section. After erection and glazing, adjust doors and hardware to operate properly.

3.6 CLEANING AND PROTECTION

3.6.1 General

At the completion of the installation, clean the work to remove mastic smears and other foreign materials.

3.6.2 Glass

Upon completion of wall system installation, thoroughly wash glass surfaces on both sides and remove labels, paint spots, putty, compounds, and other defacements. Replace cracked, broken, and defective glass with new glass at no additional cost to the Government.

3.6.3 Aluminum Surfaces

Protection methods, cleaning, and maintenance must be in accordance with AAMA 609 & 610.

3.7 INSTALLATION TOLERANCES

Install curtain walls within the following tolerances:

Deviation in location from that indicated on the drawings	Plus or minus 1/4 inch
Deviation from the plumb or horizontal	
In 12 feet of length	Not more than 1/8 inch
In any total length	Not more than 1/2 inch
Offset from true alignment at joints between abutting members in line	Not more than 1/16 inch

3.8 INSPECTION AND ACCEPTANCE PROVISIONS

3.8.1 Finished Curtain-Wall System Requirements

Curtain-wall work must be rejected for any of the following deficiencies:

Finish of exposed-to-view aluminum having color and appearance that are outside the color and appearance range.

Installed curtain-wall components having stained, discolored, abraded, or otherwise damaged exposed-to-view surfaces that cannot be cleaned or repaired.

Aluminum surfaces in contact with dissimilar materials that are not

protected as specified.

3.8.2 Repair of Defective Work

Remove and replace defective work with curtain-wall materials that meet the specifications at no expense to the Government.

-- End of Section --